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DEVICE FOR DETECTING A POLE CRASH

BACKGROUND INFORMATION

The present invention relates to a device for detecting a pole crash.

SUMMARY

An example device according to the present invention for recognizing a pole crash may have the advantage that the pole crashes are more easily identified. A pole crash is understood here as a crash against a small-volume object, the structures provided for absorbing crash energy not being affected. This includes utility poles, masts, and wall edges. Pole crashes have the property that they have very small deceleration values in their initial phase. Due to the small impact surface and the non-involvement of the vehicle structures designed to absorb energy, which typically include the side members up to the bumper, initially only little energy is absorbed, and the pole penetrates deep into the vehicle front even at low impact velocities. Substantial deceleration does not occur until the pole hits the engine block. The deceleration is then much more intense than in the case of a higher-speed impact against a softer barrier, so that deployment of the restraining device is necessary to protect the occupants. This prevents the two types of crash from being confused with one another.

According to the present invention, the impact velocity and the distance between the first contact point, i.e., the bumper, and the engine block are known; therefore, it is possible to calculate the time to the initial occurrence of the high deceleration values. This permits a pole crash to be reliably recognized and the restraining device to be accurately controlled.

It may be particularly advantageous if the time between the moment of first impact between the impact object and the vehicle and the moment when the impact object hits the engine block is measured using the impact velocity and/or the acceleration. This may be used to identify a pole crash.

Finally, it may also advantageous if the environment sensor is designed either as a radar sensor or as an ultrasonic sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the present invention are illustrated in the figure and explained in more detail below.

Figure 1 shows a block diagram of an example device according to the present invention.

Figure 2 shows a diagram for illustrating a pole crash.

Figure 3 shows a flow chart of an example method according to the present invention.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

Pole crashes are crashes in which an impact object, which initially causes only a slight deceleration of the vehicle, has a minimal surface area. In the initial phase, the acceleration signal of this crash corresponds with that of higher-speed crashes against soft, deformable barriers, for example, of a vehicle-vehicle crash. In some cases, the acceleration values are even lower. It is required, however, that the airbag or other restraining device does not deploy in crashes against soft barriers, but they must deploy in pole crashes.

According to an example embodiment of the present invention, the processor in the control unit which evaluates the sensor signals of a sensor for detecting the impact velocity and/or a sensor for detecting the acceleration is configured in such a way that the processor is able to better identify a pole crash. This is advantageously possible by measuring the time between the moment of first impact of the impact object against the vehicle and the moment the impact object hits the engine block. A pole crash is easily identifiable from this time via signal analysis.

Impact object is understood here as any object which collides with the vehicle in which the device according to the present invention for detecting a pole crash is installed. In this application, this will typically mean a utility pole. However, it may also be any other object causing such a pole crash.

Figure 1 shows an example device according to the present invention as a block diagram. An environment sensor 1 is connected to a control unit 3 via a first data input. Furthermore, an

acceleration sensor 2 is connected to a second data input of control unit 3. A processor 4 running an algorithm used for recognizing a pole crash is situated in control unit 3. It is possible that other algorithms are run in addition to this algorithm to identify different crash types and thus to permit deployment of restraining devices as appropriate. Control unit 3 is connected to restraining device 5 via a data output. The restraining device 5 may include, for example, airbags and/or seat belt tighteners, and/or a rollover bar. The trigger for restraining device 5 may be situated either in control unit 3 or in restraining device 5.

Only one environment sensor 1 and one acceleration sensor 2 are illustrated here as an example. It is, however, possible to use more than one environment sensor 1 and more than one acceleration sensor 2. In the present case both sensors 1 and 2 are situated outside the control unit. A unidirectional data transmission from sensors 1 and 2 to control unit 3 is also provided here in particular. This line may also be used for powering sensors 1 and 2 from control unit 3. Environment sensor 1 is a radar sensor or ultrasonic sensor, for example, and is preferably installed in the front of the vehicle. It is possible to place additional environment sensors on the vehicle body to permit complete environment sensing around the vehicle. Using a radar sensor or ultrasonic sensor, it is possible, in particular, to determine the velocity of an object that has been detected. Acceleration sensor 2 is used as an impact sensor, i.e., acceleration sensor 2 does not register significant acceleration until an impact occurs; the reduction of velocity may be determined from this acceleration by simple integration and the forward displacement may be determined by double integration. In a pole crash significant forward displacement occurs when the pole hits the engine block, which may be hazardous to the occupants' bodily integrity if the restraining device is not employed. Therefore, the use of a restraining device at an appropriate point in time is necessary in the event of such a pole crash.

An acceleration sensor may be additionally or alternatively situated in control unit 3 itself. In addition to acceleration sensor 2, it is also possible to use other sensors for detecting an impact. Such sensors include in particular deformation sensors or indirect deformation sensors, such as temperature sensors or pressure sensors. Control unit 3 is typically situated at the center of the vehicle, e.g., on the vehicle tunnel. It is, however, possible to associate this control unit with each of the individual sensors, the control unit communicating, for example via a vehicle bus, with another control unit which then triggers restraining means 5.

Figure 3 illustrates the algorithm running on processor 3. In method step 100, sensors 1 and 2 determine the impact velocity or the acceleration which is occurring. The reduction in velocity and the forward displacement are determined by integrating the acceleration signal. This provides the particular advantage that high-frequency components are filtered out of the signal. The forward displacement signal is the most robust and is to be therefore preferably used. An object of the example method according to the present invention is to correctly recognize a pole crash and to distinguish it from a higher-speed crash against a softer barrier, such as another vehicle. The pole crash has a smaller forward displacement at the time of deployment than the higher-speed, softer crash. As a result, the pole crash, as shown by curve 12 in Figure 2, is further above deployment threshold 13 than non-deploying, higher-speed, softer crash 11. Figure 2 shows a distance-time diagram. The double integral of acceleration is used here. Threshold 13 is a function of the measured impact velocity.

The method is now started in method step 100 and the threshold comparison is carried out according to Figure 2. Up to the moment of deployment, the pole crash has a smaller forward displacement than the higher-speed, softer crash. As Figure 2 shows, pole crash 11 is therefore further above deployment threshold 12 than non-deploying, higher-speed, softer crash 13. The pole crash would therefore be classified as a non-deployer. An additional deployment criterion must therefore be derived in method step 101. This discussion is based on the fact that in a pole crash significant deceleration occurs when the engine block is hit. The impact velocity and the distance between the bumper and the engine block are known, and therefore the time between the first crash contact and the moment the pole hits the engine block may be computed using the formula time = distance/impact velocity. Approximately at this time, significant deceleration and significant increase in forward displacement must be observed. A pole crash is then recognized and the restraining device is deployed accordingly. This makes very accurate deployment of the restraining device possible. This comparison is performed in method step 102, where a check is performed as to whether there is forward displacement at this time. If this is the case, the method jumps to method step 103, and the restraining device 5 is deployed accordingly. If this is not the case, the method jumps back to method step 100.

ABSTRACT

A device for recognizing a pole crash, situated in a vehicle. The pole crash is determined on the basis of an impact velocity, which is recognized by an environment sensor, and an acceleration, which occurs in upon impact and is recognized by an impact sensor. In particular, the time between the impact and the impact object hitting the engine block is determined to identify a pole crash.

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DEVICE FOR DETECTING A POLE CRASH

Background Information

The present invention is directed to a device for detecting a pole crash according to the definition of the species in the independent claim.

Advantages of the Invention

The device according to the present invention for recognizing a pole crash, having the features of the independent claim, has the advantage that, using the device according to the present invention pole crashes are more easily identified. A pole crash is understood here as a crash against a small-volume object, the structures provided for absorbing crash energy not being affected. This includes utility poles, masts, and wall edges. Pole crashes have the property that they have very small deceleration values in their initial phase. The present invention is based on the fact that, due to the small impact surface and the non-involvement of the vehicle structures designed to absorb energy, which typically include the side members up to the bumper, initially only little energy is absorbed, and the pole penetrates deep into the vehicle front even at low impact velocities. Substantial deceleration does not occur until the pole hits the engine block. The deceleration is then much more intense than in the case of a higher-speed impact against a softer barrier, so that deployment of the restraining means is necessary to protect the occupants. This prevents the two types of crash from being confused with one another.

The impact velocity and the distance between the first contact point, i.e., the bumper, and the engine block are known; therefore, it is possible to calculate the time to the initial occurrence of the high deceleration values. This permits a pole crash to be reliably recognized and the restraining means to be accurately controlled.

The measures and further refinements recited in the dependent claims make possible advantageous improvements of the device for recognizing a pole crash described in the independent claim.

It is particularly advantageous that the time between the moment of first impact between the impact object and the vehicle and the moment when the impact object hits the engine block is measured using the impact velocity and/or the acceleration. This may be used to identify a pole crash.

Finally, it is also advantageous that the environment sensor is designed either as a radar sensor or as an ultrasonic sensor.

Drawing

Exemplary embodiments of the present invention are illustrated in the drawing and explained in more detail in the description that follows. Figure 1 shows a block diagram of the device according to the present invention; Figure 2 shows a diagram for elucidating a pole crash; and Figure 3 shows a flow chart of the method according to the present invention.

Description

Pole crashes are crashes in which an impact object, which initially causes only a slight deceleration of the vehicle, has a minimal surface area. In the initial phase, the acceleration signal of this crash corresponds with that of higher-speed crashes against soft, deformable barriers, for example, of a vehicle-vehicle crash. In some cases, the acceleration values are even lower. It is required, however, that the airbag or other restraining means do not deploy in crashes against soft barriers, but they must deploy in pole crashes.

According to the present invention, the processor in the control unit which evaluates the sensor signals of a sensor for detecting the impact velocity and/or a sensor for detecting the acceleration is configured in such a way that the processor is able to better identify a pole crash. This is advantageously rendered possible by measuring the time between the moment of first impact of the impact object against the vehicle and the moment the impact object hits the engine block. A pole crash is easily identifiable from this time via signal analysis.

Impact object is understood here as any object which collides with the vehicle in which the device according to the present invention for detecting a pole crash is installed. In this application, this will typically mean a utility pole. However, it may also be any other object causing such a pole crash.

Figure 1 shows the device according to the present invention as a block diagram. An environment sensor 1 is connected to a control unit 3 via a first data input. Furthermore, an acceleration sensor 2 is connected to a second data input of control unit 3. A processor 4 running an algorithm used for recognizing a pole crash is situated in control unit 3. It is possible that other algorithms are run in addition to this algorithm to identify different crash types and thus to permit deployment of restraining means as appropriate. Control unit 3 is connected to restraining means 5 via a data output. These restraining means 5 include, for example, airbags and/or seat belt tighteners, and/or a rollover bar. The trigger for restraining means 5 may be situated either in control unit 3 or in restraining means 5.

Only one environment sensor 1 and one acceleration sensor 2 are illustrated here as an example. It is, however, possible to use more than one environment sensor 1 and more than one acceleration sensor 2. In the present case both sensors 1 and 2 are situated outside the control unit. A unidirectional data transmission from sensors 1 and 2 to control unit 3 is also provided here in particular. This line may also be used for powering sensors 1 and 2 from control unit 3. Environment sensor 1 is a radar sensor or ultrasonic sensor, for example, and is preferably installed in the front of the vehicle. It is possible to place additional environment sensors on the vehicle body to permit complete environment sensing around the vehicle. Using a radar sensor or ultrasonic sensor, it is possible, in particular, to determine the velocity of an object that has been detected. Acceleration sensor 2 is used as an impact sensor, i.e., acceleration sensor 2 does not register significant acceleration until an impact occurs; the reduction of velocity may be determined from this acceleration by simple integration and the forward displacement may be determined by double integration. In a pole crash significant forward displacement occurs when the pole hits the engine block, which may be hazardous to the occupants' bodily integrity if restraining means are not employed. Therefore, the use of restraining means at an appropriate point in time is necessary in the event of such a pole crash.

An acceleration sensor may be additionally or alternatively situated in control unit 3 itself. In addition to acceleration sensor 2, it is also possible to use other sensors for detecting an impact. Such sensors include in particular deformation sensors or indirect deformation sensors, such as temperature sensors or pressure sensors. Control unit 3 is typically situated at the center of the vehicle, e.g., on the vehicle tunnel. It is, however, possible to associate this control unit with each of the individual sensors, the control unit communicating, for example via a vehicle bus, with another control unit which then triggers restraining means 5.

Figure 3 visualizes the algorithm running on processor 3. In method step 100, sensors 1 and 2 determine the impact velocity or the acceleration which is occurring. The reduction in velocity and the forward displacement are determined by integrating the acceleration signal. This provides the particular advantage that high-frequency components are filtered out of the signal. The forward displacement signal is the most robust and is to be therefore preferably used. The object of the method according to the present invention is to correctly recognize a pole crash and to distinguish it from a higher-speed crash against a softer barrier, such as another vehicle. The pole crash has a smaller forward displacement at the time of deployment than the higher-speed, softer crash. As a result, the pole crash, as shown by curve 12 in Figure 2, is further above deployment threshold 13 than non-deploying, higher-speed, softer crash 11. Figure 2 shows a distance-time diagram. The double integral of acceleration is used here. Threshold 13 is a function of the measured impact velocity.

The method is now carried out in method step 100 and the threshold comparison is carried out according to Figure 2. Up to the moment of deployment, the pole crash has a smaller forward displacement than the higher-speed, softer crash. As Figure 2 shows, pole crash 11 is therefore further above deployment threshold 12 than non-deploying, higher-speed, softer crash 13. The pole crash would therefore be classified as a non-deployer. An additional deployment criterion must therefore be derived in method step 101. This discussion is based on the fact that in a pole crash significant deceleration occurs when the engine block is hit. The impact velocity and the distance between the bumper and the engine block are known, and therefore the time between the first crash contact and the moment the pole hits the engine block may be computed using the formula time = distance/impact velocity. Approximately at this time, significant deceleration and significant increase in forward displacement must be observed. A pole crash is then recognized and the restraining means are deployed accordingly. This makes very accurate deployment of the pole crash possible. This

comparison is performed in method step 102, where a check is performed as to whether there is forward displacement at this time. If this is the case, the method jumps to method step 103, and restraining means 5 are deployed accordingly. If this is not the case, the method jumps back to method step 100.